Contribution ID: **303** Type: **Overview Presentation**

OV/2-4: Overview of KSTAR Results

Monday, 8 October 2012 15:15 (25 minutes)

After the first H-mode discharge in 2010, the H-mode has been sustained longer and the operational regime of plasma parameters has been significantly extended. Due to the proper tuning of equilibrium configuration and plasma control, values of βN = 1.9 and Wtot = 340 kJ have been achieved with energy confinement time τE = 171 ms. Typical H-mode discharges were operated with the plasma current of 600 kA at the toroidal magnetic field BT = 2 T. L-H transition was obtained with 0.8-1.5 MW of PNBI in double null (DN) configuration and the H-mode lasted up to ˜5 sec. The measured power threshold as a function of density shows a roll-over with the minimum value of ˜0.8 MW at n¯_e˜2x1019 m-3. Based on the achievement of high beta H-mode, various methods of ELM control has been implemented including RMP(Resonant Magnetic Perturbation), SMBI(Supersonic Molecular Beam Injection), vertical jogging and ECCD injection on the pedestal.
We observed various ELM responses, i.e., suppression, mitigation and mode locking depending on the relative phases of the IVC coils. During ELMs suppression by 90 degree phase n=1 RMP, ELMs were completely suppressed. ELM pace making by fast vertical jogging of the plasma column has been also demonstrated. A newly installed SMBI system was also utilized for ELM control and a state of mitigated ELMs for a few tens of ELM periods has been sustained by the optimized repetitive SMBI pulses. A simple cellular automata (Sand-pile) model predicts that shallow deposition near the pedestal foot induced small-sized high-frequency ELMs mitigating large natural ELMs. In addition to the ELM control experiments mentioned above, various physics topics were explored focusing on ITER related physics issues such as the intrinsic rotation driven by RF power injection and sawtooth physics in H-mode.
In 2012, goal of the machine performance is the long pulse H-mode over 10 s which would be the first step for validating the physics issues at the normal conductor tokamak.

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Session Classification: Overview

Track Classification: OV - Overviews